[0024] In yet another aspect, the invention provides microchannel apparatus, comprising: a plurality of parallel interior microchannels sharing a common manifold; wherein each microchannel of the plurality of parallel interior microchannels comprises a microchannel wall; and a contiguous post-assembly coating along a channel length of at least 5 cm of the microchannel wall of at least 90% of the microchannels in the plurality of microchannels wherein the post-assembly coating has a first average thickness over the first 20% of axial length of the contiguous post-assembly coating (measured perpendicular to the microchannel length and in the direction in which a coating grows away from the wall) of at least 1 μm, and a second average thickness over the last 20% of axial length of the contiguous post-assembly coating (measured perpendicular to the microchannel length and in the direction in which a coating grows away from the wall) of at least 1 μm, wherein the first 20% of the contiguous post-assembly coating and the last 20% of the contiguous post-assembly coating have coating loadings that are within 20% of each other in the at least 90% of the microchannels in the plurality of microchannels of parallel interior microchannels sharing a common manifold. The first 20% and the last 20% can be arbitrarily selected, this language merely refers to the beginning and end of a continguous coating in a microchannel. In the plurality of parallel microchannels, these coatings are averaged and the coating loading at one end of the plurality of microchannels is about the same (within 20%) as at the other end. In a preferred washcoating procedure, the second 20% is oriented above the first 20% (with respect to gravity) and the microchannel wall on which the second 20% is disposed comprises capillary features.

[0025] In a further aspect, the invention provides a method of washcoating a microchannel device, comprising: adding a liquid coating composition into a plurality of parallel interior microchannels sharing a common manifold; draining the liquid from the plurality of parallel interior microchannels sharing a common manifold; and further comprises at least one step of: (a) wicking liquid out from the plurality of parallel interior microchannels sharing a common manifold; (b) removing liquid from the plurality of parallel interior microchannels sharing a common manifold with a purging of gas flow that is of sufficiently low flow so that flow through any microchannel in the plurality of parallel interior microchannels sharing a common manifold is within 50% of that of the average flow through each of the microchannels in the plurality of parallel interior microchannels sharing a common manifold; or (c) applying vacuum to a subset of the plurality of parallel interior microchannels sharing a common manifold.

[0026] In another aspect, the invention provides a method of applying a uniform metal coating onto a microchannel wall of an interior microchannel, comprising: filling an interior microchannel to a desired height with an electroless plating liquid; allowing the liquid to remain in the interior microchannel while a metal plates onto a wall or walls of the microchannel; and then cooling the liquid prior to draining to reduce the rate of reaction, or reacting the electroless plating solution within the microchannel until one of the essential reactants is substantially depleted within the microchannel; and then draining the liquid from the microchannel.

[0027] In a further aspect, the invention provides microchannel apparatus, comprising: an interior microchannel comprising at least one microchannel wall; wherein the interior microchannel comprises at least two corners having angles of at least 45° and at least one flat area between the corners; and a post-assembly coating. The post-assembly coating comprises a corner thickness that is measured along a line bisecting the corner angle; wherein the post-assembly coating comprises a coating on the flat area having a flat area coating thickness; and wherein the corner thickness is no more than 50% greater than the flat area coating thickness. Alternatively, the average thickness ((d1+d2)/2) of the coating at the perimeter of the corner coating (see **FIG. 13*b***) based on extensions (d1 and d2) of 100 μm lines used to measure coating angle; preferably this thickness of the coating at the perimeter of the corner coating is within 25%, more preferably within 10% of either the average coating thickness (averaged over a microchannel wall, or 100 μm microchannel wall segment, terminating at the corner), or within 25%, more preferably within 10% of the midpoint thickness (either measured at the midpoint of a microchannel wall, or at the midpoint of a 100 μm microchannel wall segment, terminating at the corner).

[0028] In another aspect, the invention provides microchannel apparatus, comprising: a corner crevice in an interior microchannel; a post-assembly coating that substantially fills the crevice to form a crevice fill; two substantially perpendicular microchannel walls comprising a first substantially flat microchannel wall having a substantially flat post-assembly coating disposed thereon and a second microchannel wall that is substantially perpendicular to the first microchannel wall; and an interface between the post-assembly coating on the first substantially flat microchannel wall and an open microchannel. A surface of the crevice fill forms an interface with the open microchannel, and the surface of the crevice fill is at or below the level of interface between the post-assembly coating on the first substantially flat microchannel wall and an open microchannel, relative to the direction of post-assembly coating growth from the first substantially flat microchannel wall. This aspect should be understood with reference to the SEM photomicrograph. In a preferred embodiment, the first microchannel wall and the second microchannel wall are bonded to each other by diffusion bonding or brazing.

[0029] In another aspect, the invention provides microchannel apparatus, comprising: a plurality of discontinuous recessed or protruded capillary features whose protruded or recessed depth is less than 40% of the minimum dimension of the microchannels in which the capillary features are disposed; wherein the capillary features are contained within at least three or more parallel microchannels; and wherein the capillary features have at least one dimension less than 1 mm. Preferably, there is at least 40% more mass of washcoat material on areas having capillary feature than on flat areas of the microchannel walls. In a related aspect, the invention provides methods of forming capillary features comprising laser cutting, roll forming, electrodischarge machining, photochemical machining, and/or laser ablation.

[0030] In another aspect, the invention provides a method of precisely filling multimicrochannels in a multichannel, microchannel device, comprising: orienting a multichannel, microchannel device with respect to gravity such that long axes of the microchannels in the device, in a selected region of the device, are oriented parallel to gravity; adding liquid from a liquid source into multiple microchannels in the